AD-A150 066 YADKIN - PEE DEE RIVER NORTH AND SOUTH CAROLINA 4-9 NOVEMBER 1977(U) CORPS OF ENGINEERS CHARLESTON SC CHARLESTON DISTRICT 29 MAR 78 1/1

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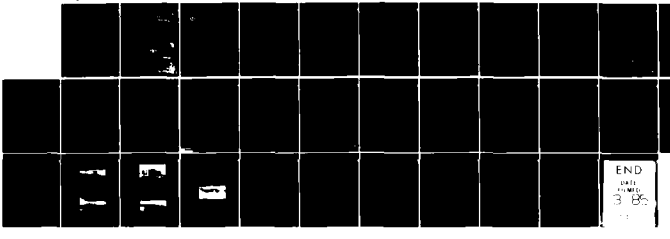

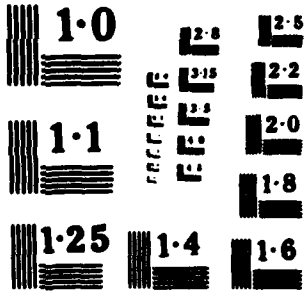
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AD-A150 066

HYDROLOGY

REPORT OF THE FLOOD

OF

4 THRU 9 NOVEMBER 1977

YADKIN – PEE DEE RIVER
NORTH AND SOUTH CAROLINA

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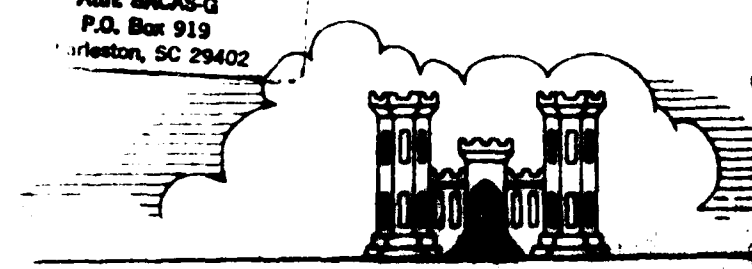

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CORPS OF ENGINEERS
CHARLESTON, SOUTH CAROLINA

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CHARLESTON DISTRICT, CORPS OF ENGINEERS
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SACEN-PH

29 March 1978

SUBJECT: Final Report on the Flood of 5 Nov thru 9 Nov 1977, Yadkin-Pee Dee River, North and South Carolina

HQDA (DAEN-CWO-E)
WASH DC 20314

1. Authority. This report was prepared under provisions contained in PL-99, which delegates authority to District Engineers to prepare post-disaster reports.

2. Purpose. The purpose of this report is to present and document the basic data that was collected on the storm that occurred over the Yadkin River watershed 5-7 Nov 1977 and on the subsequent flooding which followed. Most of the ~~Yadkin River~~ watershed lies in North Carolina and is a part of the Yadkin-Pee Dee River System. A general basin map of this river system is shown on Figure 1.

3. Scope of report. This report summarizes the hydrologic, economic and other data collected which were considered of significance and were readily available. Following the subsidence of flooding, a flood damage survey was made by ~~Charleston~~ District personnel of the subject area. Subsequent office studies included an evaluation of flood damages and a brief hydrologic analysis. Data obtained through the flood damage survey were supplemented by and compared with the stage damage data derived for the "Report on Development of Water Resources in Appalachia" and for the Reddies River Lake Phase I General Design Memorandum.

4. In addition to the flood damage assessment and presentation of the hydrologic data collected, an operation summary is also included of the W. Kerr Scott Dam and Reservoir, a Corps of Engineers multiple purpose project, and the effect it had on flood conditions along the upper Yadkin River. Also included are the effects that the authorized Reddies and Roaring River Lake projects would have had on flood conditions had they been operational.

SACEN-PH 29 March 1978
SUBJECT: Final Report on the Flood of 5 Nov thru 9 Nov 1977, Yadkin-Pee Dee River, North and South Carolina

STORM DATA

5. General. Precipitation for the month of October was above normal for most of the State of North Carolina. Heavy rains fell on 26 October at most stations including those in the upper Yadkin River Basin. From that time through the first few days of November, light rain and drizzle predominated throughout the State. However, during the latter part of the first week of November, a moisture-laden low pressure system moved into the area, resulting in heavy rains on the 5th and 6th especially on the upslope areas of the western mountains. Total storm precipitation amounts ranging from 7 to 13 inches with estimates up to 15 inches were reported throughout the northern mountain and Piedmont zones. Lighter precipitation amounts were reported at some stations on the 7th as the system moved northward out of the State. A comparison of the recorded November precipitation to the monthly normals, as well as the maximum three-day accumulations produced by the storm is presented in Table 1.

TABLE 1

NOVEMBER 1977 PRECIPITATION-UPPER YADKIN RIVER BASIN
NORMAL AND RECORDED ACCUMULATIONS IN INCHES

Station	Total for Nov 4-7*	Total for Month of Nov	Normal for November
Blowing Rock	6.67	--	--
Boone	6.24	8.64	4.04
Elkin	3.19	4.82	2.87
Glendale Springs	11.56	14.31	--
Mocksville	2.90	4.88	2.84
North Wilkesboro	4.95	6.97	3.08
Patterson	9.14	10.68	2.96
Wilbar	6.27	--	3.55
W. Kerr Scott	6.86	8.89	2.63
Yadkinville	1.55	3.24	--

* Midnight to Midnight

6. Description of Flood-producing Storm. During the latter part of October, a short wave trough moved slowly southeast into the Gulf of Mexico. By mid-week, or about Nov. 2nd, it was cut off forming a closed low, thus spawning a surface low pressure system laden with moisture. This system was centered over extreme southwestern Alabama and extended vertically over this area through the 500 mb. level. This type of weather system results in a southerly to southeasterly flow of moist air over the western mountains of North Carolina. This flow of air produces an orographic condition caused by the presence of these obstacles and leads to a greater release of precipitation on the eastern and southern slopes of the mountain ranges. As a result of this weather system, light intermittent rains began in the Southern Appalachians on Tuesday, November 2nd and continued for the next three days. Heavy rainfall moved northeast over the Carolinas late on November 5th, inundating parts of Georgia adjacent to the Savannah River Basin, then slipping across South Carolina to Hogback Mountain near the North Carolina line. The eastern slopes of the mountains received large amounts of precipitation. Totals of 6 to 8 inches were reported at locations around Asheville, N. C. and 7 to 10 inches were measured in the vicinity of Boone. Unofficial estimates ran as much as 12 inches in the higher elevations from west of Asheville to Boone for the 24-hour period ending at 0800 on Sunday, November 6th. An isohyetal map for the upper Yadkin River watershed for the storm period of 4-7 November is shown on Figure 2. Mass curves of rainfall for representative stations are shown in Figure 3.

FLOOD DATA

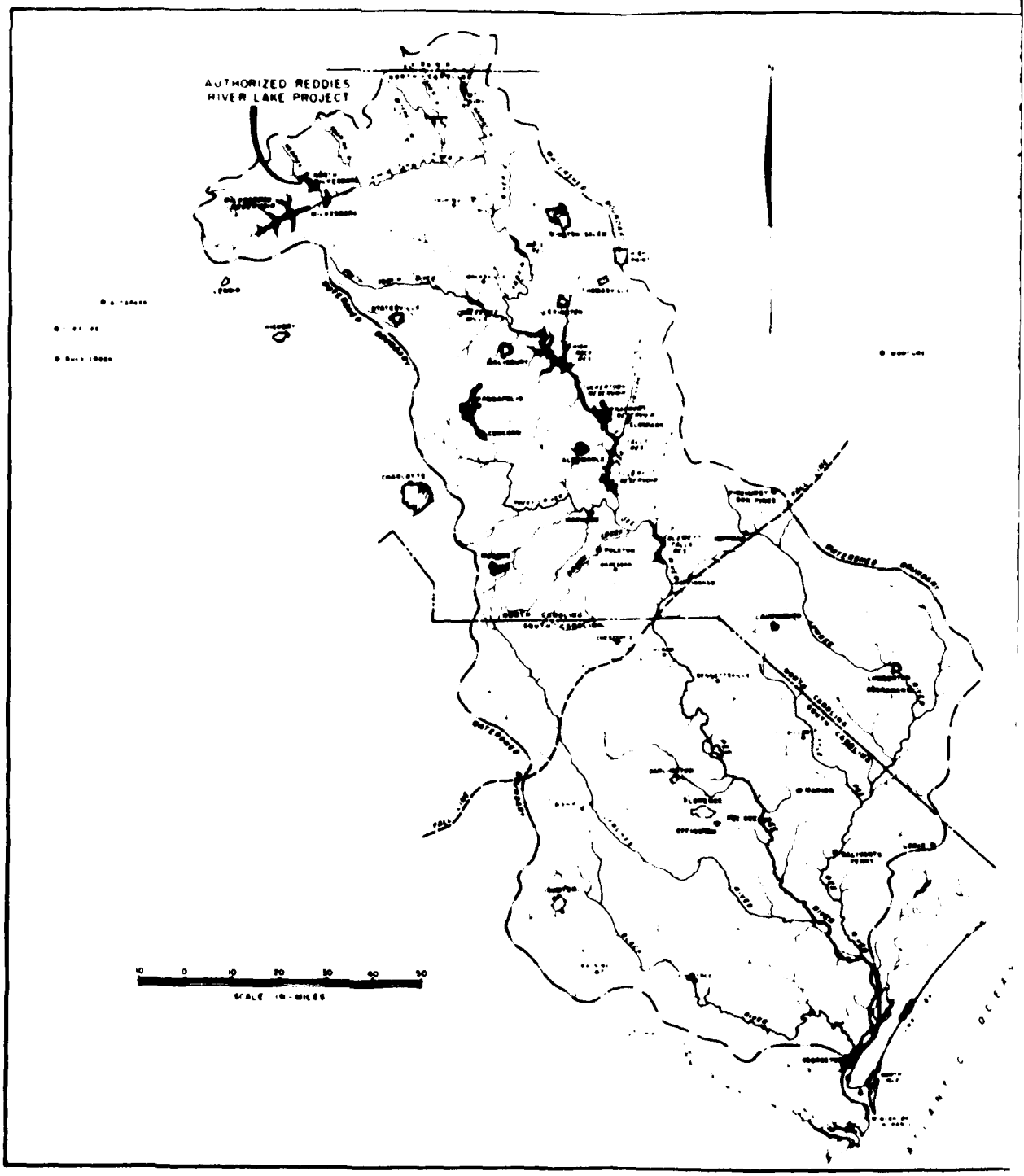
7. General. rainfall on the fifth and sixth of November produced high flows on the Yadkin River as well as most other streams in the western mountains of North Carolina. The flood catastrophe left 11 dead and estimated damages of $60 to $70 million, a large part of which occurred in the French Broad and Nolichucky Basins, particularly in Yancy County where damages were estimated at $40 million. Flooding on the Upper Yadkin River was relatively minor because river stages were considerably reduced by the operation of W. Kerr Scott Dam and Reservoir. However, this report, except for just a few deviations, deals only with the flooding that occurred in the Yadkin-Pee Dee River Basin. All recorded river stage and flow data presented in this report are those reported by the U. S. Geological Survey using data obtained from their stream-gaging stations.

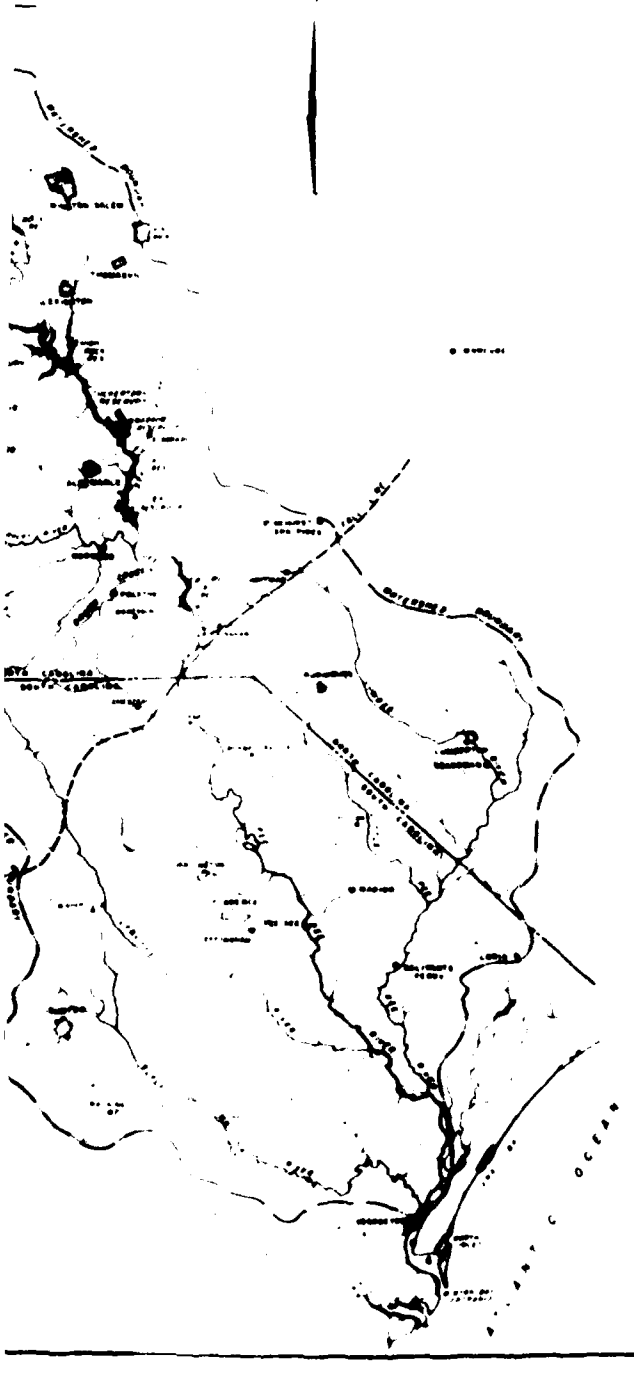
8. Flow Rates and Water Levels Immediately Preceding Flood. Stream flows on the Yadkin River were at or below normal for the latter part of October and early part of November. At 0800 on November 5th, when rainfall began to intensify, stages and flow rates at the Wilkesboro and Elkin stream gaging stations were 6.5 ft. and 4200 cfs and 3.4 ft. and 1515 cfs, respectively. By this time, due to the relatively light rains on the preceding days, the pool elevation at W. Kerr Scott Reservoir had increased from 1029.95 on November 1st to 1032.1 on the 5th. The normal pool elevation for this lake is 1030.0.

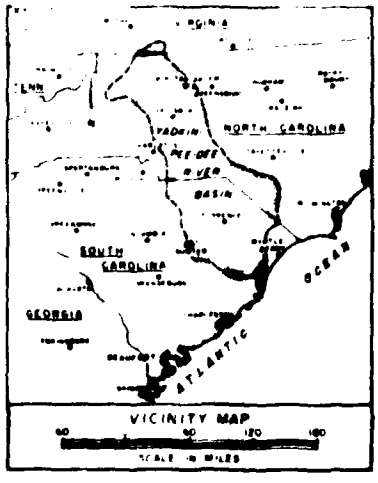
9. Recorded Peaks. Flooding in the Yadkin-Pee Dee River Basin was not as severe as the flooding that occurred in the adjoining basins in western North Carolina. Yadkin-Pee Dee Basin flooding was greater in the upper portion of the basin than in the lower. Only minor flooding occurred downstream of High Rock Lake on the Pee Dee River. The Pee Dee River at Pee Dee, South Carolina reached a crest of 19.5 feet on November 12th. This crest was only 0.5 foot above flood stage. In the upper portion of the basin, the Yadkin River crested at Wilkesboro at 15.52 feet at 1500 hours on November 6th. This crest was 1.52 feet above flood stage. At Elkin, the Yadkin River reached a crest of 21.09 feet at 0130 hours on the 7th. This peak value is 5.09 feet above the Elkin flood stage; however, the river was back within its natural banks by 1000 hours of the same day. The crests recorded on the Yadkin River at Enon and Yadkin College were respectively 19.83 and 18.07 feet or 1.83 and 0.07 feet above flood stage. This recorded peak data for the Yadkin River as well as peak data for selected tributaries are presented in Table 4. Discharge hydrographs for the Wilkesboro, Elkin, Enon and Yadkin College gages are shown on Figure 4.

10. Existing Corps of Engineers Projects. The W. Kerr Scott Dam and Reservoir is the only existing Corps of Engineers flood control project on the upper Yadkin River. It is located about 5 miles above Wilkesboro, N. C. and provides 112,000 acre-feet of flood control storage between elevations 1030 and 1075. This amount of storage is equivalent to 6.03 inches of storm runoff. Until this event, the floods of August 1970 and June 1972 were the two most severe tests of the project since its completion in August 1962. During the 1970 flood, the reservoir reached an elevation of 1060.2 ft-msl, a period of record high until exceeded by the 1061.2 maximum elevation attained by this flood event.

11. Operation of W. Kerr Scott Dam and Reservoir. During flood events, W. Kerr Scott Dam and Reservoir is operated in a manner calculated to reduce flooding from the Yadkin River to the greatest extent possible. Because project regulation can reduce flooding as


AUTHORIZED REDDIES
RIVER LAKE PROJECT





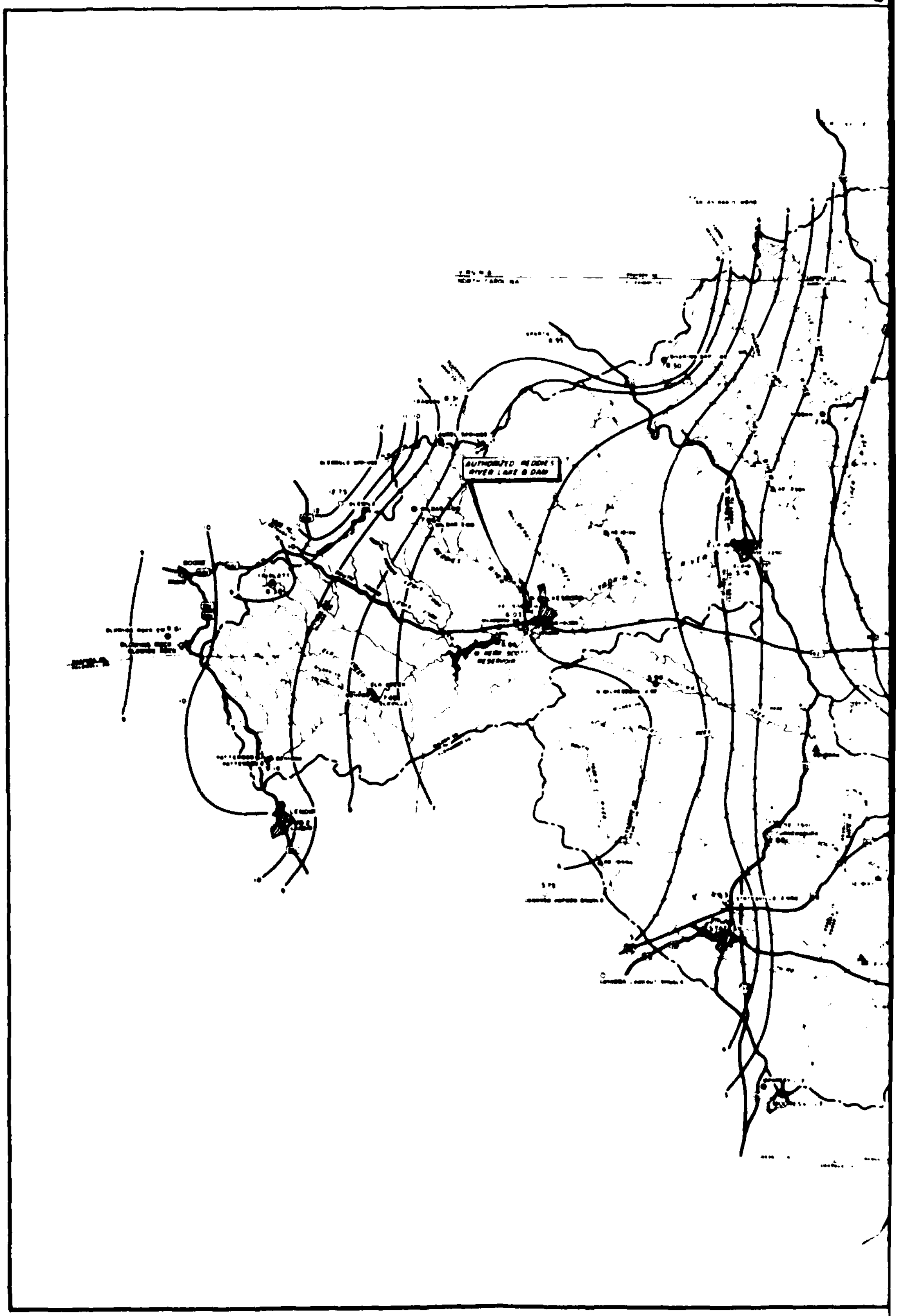
YADKIN–PEE DEE BASIN

N.C. & S.C.

GENERAL MAP

SCALE AS SHOWN

FIGURE 1


AUTHORIZED REDDIE'S
RIVER LAKE & DAM

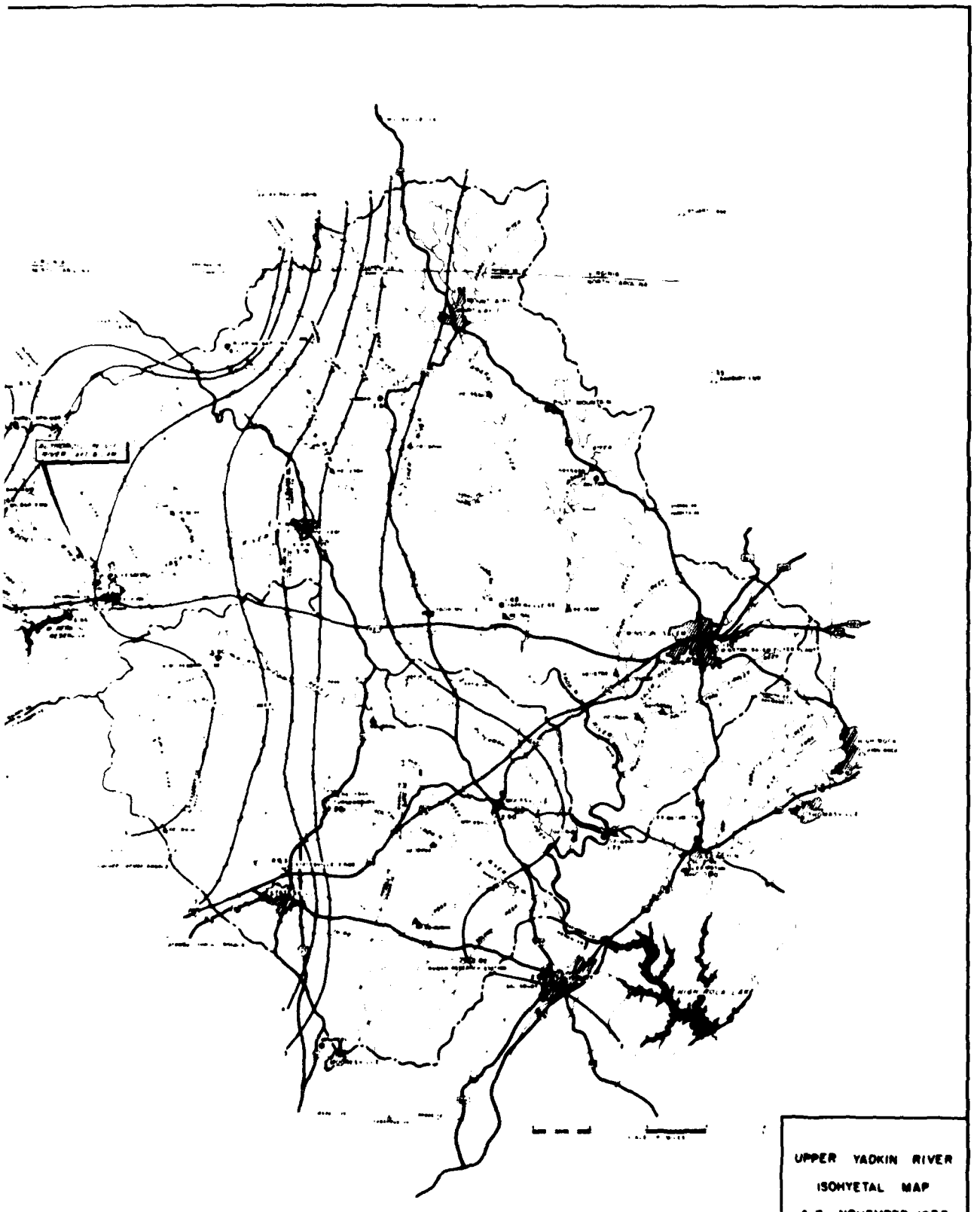
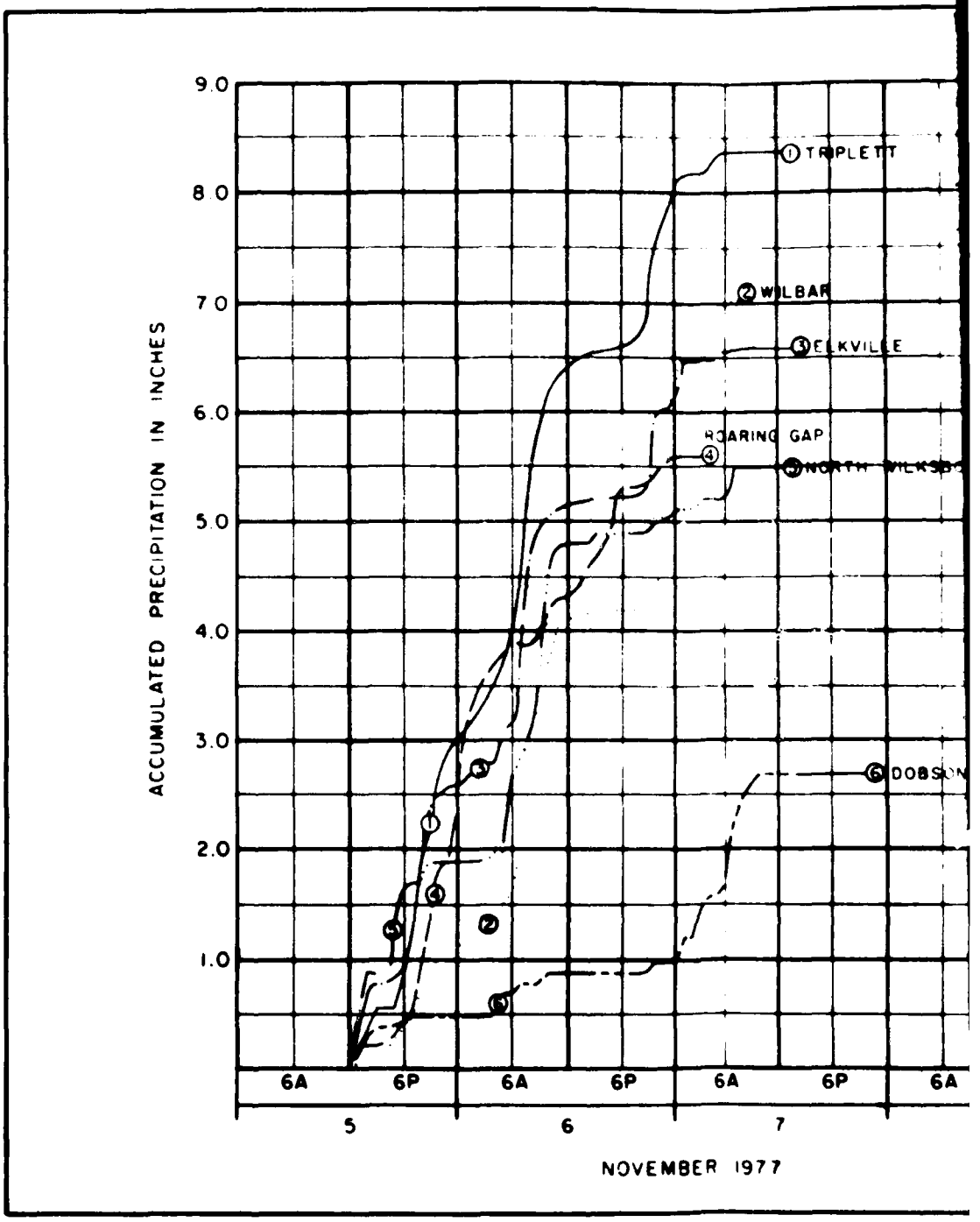
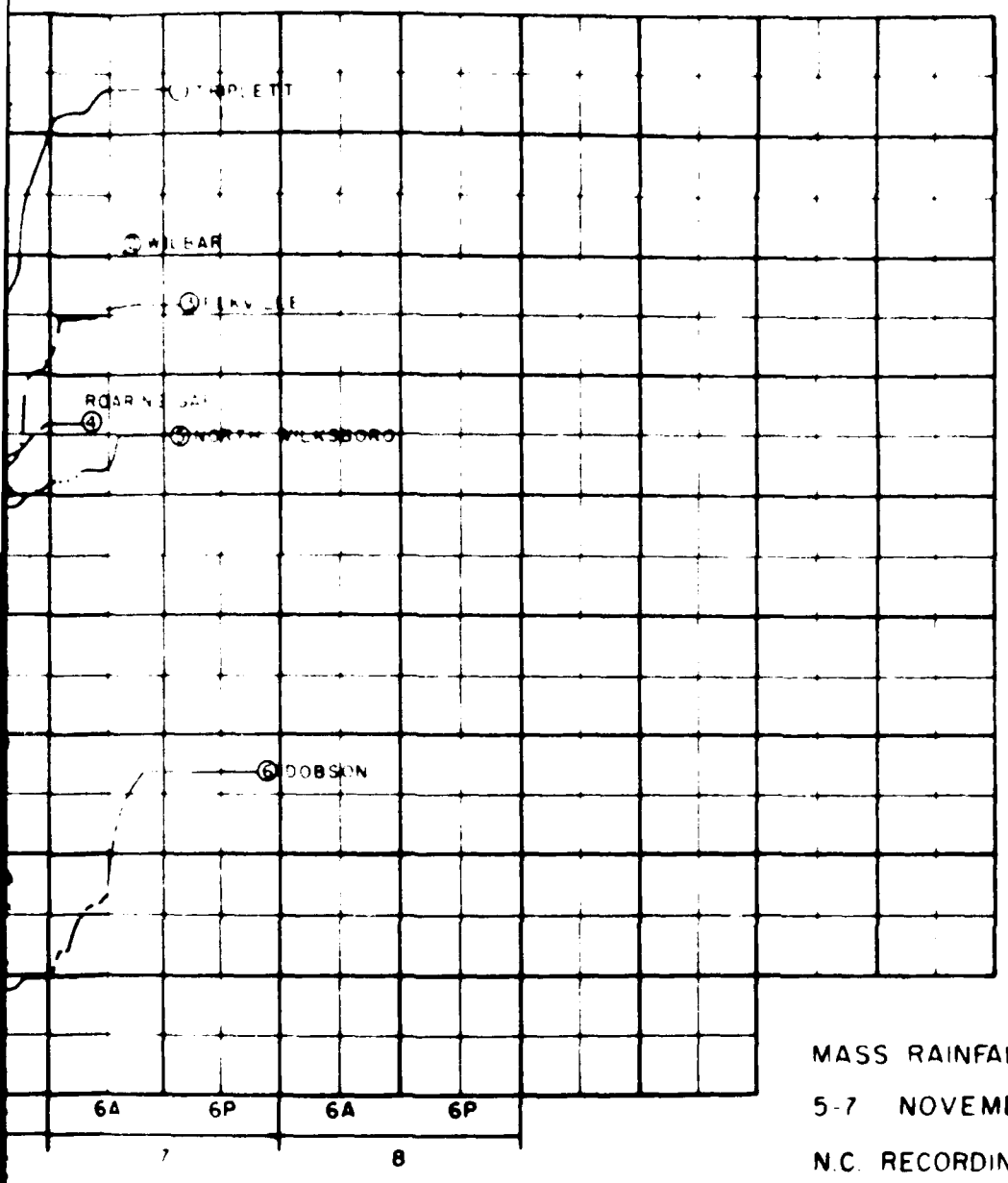


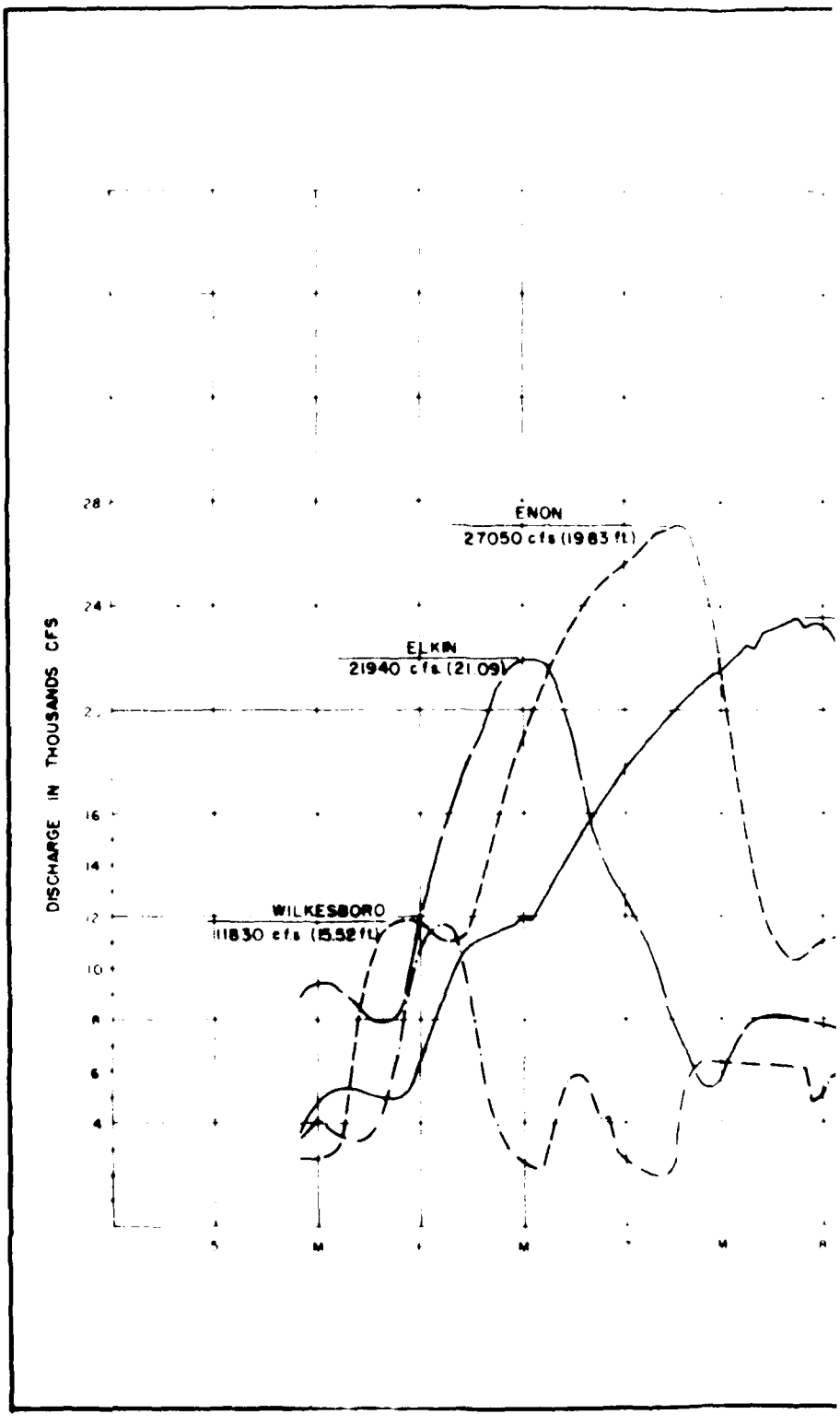
FIGURE 2

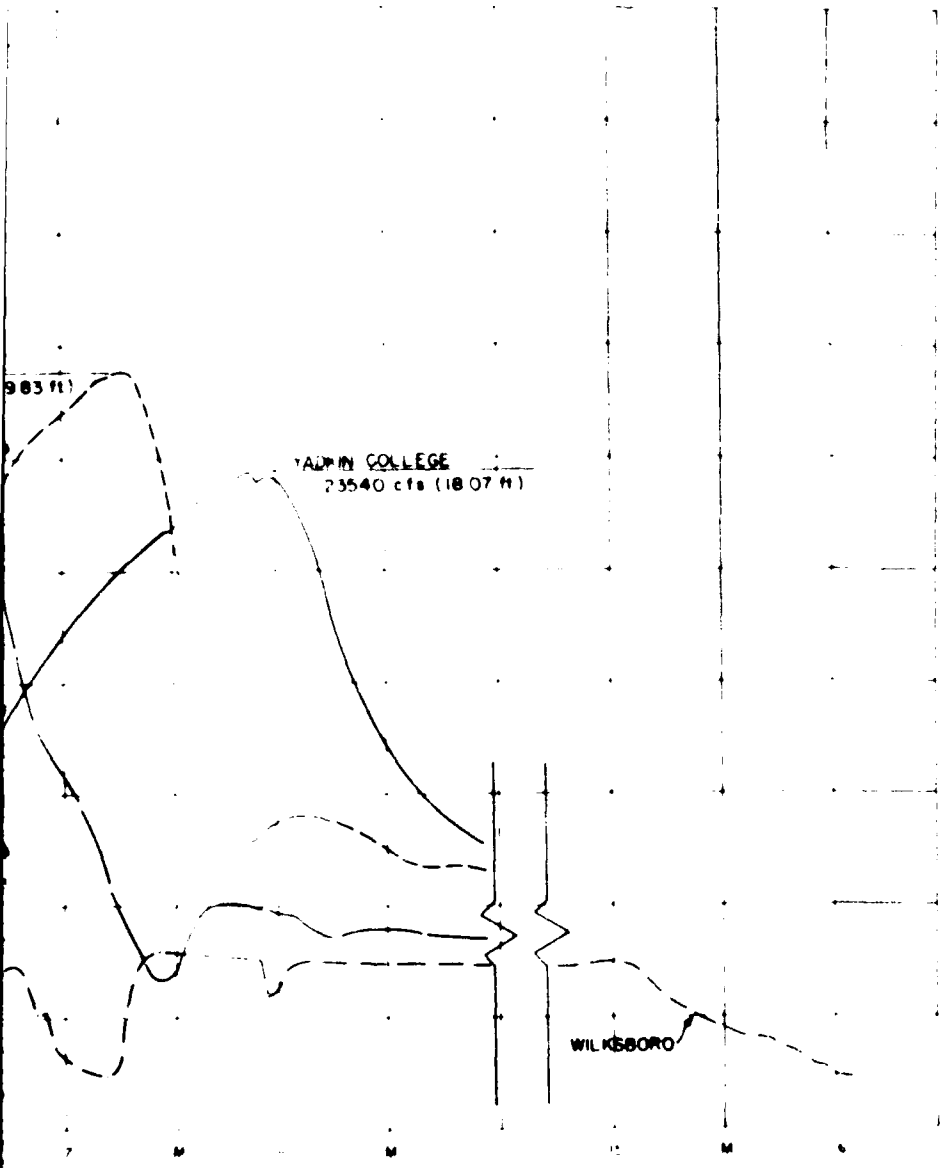

9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
ACCUMULATED PRECIPITATION IN INCHES
1 TRIPLETT
2 WILBAR
3 ELKVILLE
ROARING GAP
4
6 DOBSON
6A
6P
6A
6P
6A
6P
6A
5
6
7
NOVEMBER 1977



MASS RAINFALL CURVES
5-7 NOVEMBER 1977
N.C. RECORDING GAGES

FIGURE 3


ENON
27050 cfs (1983 ft)
ELKIN
21940 cfs (21.09)
WILKESBORO
11830 cfs (15.52 ft)
DISCHARGE IN THOUSANDS CFS
28
24
16
14
12
10
8
6
4
M
M



UPPER YADKIN RIVER

DISCHARGE HYDROGRAPHS

YADKIN RIVER, N.C.

BELOW W. KERR SCOTT RESERVOIR

FLOOD OF NOVEMBER 1977

FIGURE 4

far down the Yadkin River as High Rock Lake, river stages are monitored by both Project and District personnel down to this point. To do this, USGS stream gages on the Yadkin River at Wilkesboro, Elkin, Enon and Yadkin College are used. The stage and discharge information obtained from these gages are used by the Reservoir Regulation Unit in the Charleston District Office to direct the operation of flood gates at the project.

12. During the first few days of November, light rain and drizzle prevailed at W. Kerr Scott. At 2400 on November 5, the total precipitation accumulated at the dam over the past four days amounted to 1.31 inches. At this time the Wilkesboro gage stood at 6.5 feet and the pool elevation had increased to a value of 1032.1. Rainfall began to intensify on the evening of the 5th and the twenty-four hour total at 0800 on the 6th reached 3.8 inches. Including the 2.05 inches which fell on the 7th and the 0.09 inches which was measured on the 8th, the total storm accumulation at the project from November 1 was 7.25 inches. Flood control operation commenced with a release of 1420 cfs at 1400 hours on November 5. This release rate continued until 0800 hours on November 6, when releases were reduced to 600 cfs. One hour later, at 0900 hours, the gates were closed completely. By this time, the river at Wilkesboro had reached a stage of 9.6 feet and was rising rapidly and the Elkin gage had risen to 10.9 feet. The level of the reservoir had reached an elevation of 1038.5 at the time of gate closure. Downstream, the river continued to rise as runoff increased from the uncontrolled area below the dam. Complete impoundment of flood waters continued until 1400 hours on the 7th when a release rate of 200 cfs was initiated to correct a low flow condition in the river channel immediately below the dam. Two hours later (1600 hours) with downstream flooding on the wane, releases were increased to 2700 cfs and further increased to 5400 cfs one hour later. This last release rate, 5400 cfs, is the channel capacity below the dam. The pool elevation when releases were initiated was 1060.7 feet or 30.7 feet above normal. The maximum pool elevation attained was 0.5 feet higher (1061.2 feet-msl), and occurred at 1700 hours on November 7. A total of 65780 acre-feet of runoff (basin equivalent of 3.54 inches) or 59% of the flood control storage available was stored during this event. Although river stages in the vicinity of the Enon and Yadkin College gages were above flood stage when evacuation of the flood control space was commenced, the time to initiate these releases was carefully considered to insure that they would not add to downstream flooding. To do this, both flood recession rates and release travel times were considered. The main objective is to select a time such that when reservoir releases arrive at a given location, river stages are below flood stage.

13. Because the Yadkin River is experiencing bank stabilization problems, a protracted release rate reduction schedule was implemented. Release rates were gradually decreased as inflows decreased and the reservoir pool approached the normal operating level. This action was taken in order to mitigate any possible contribution the operation of the reservoir might have on the erosion problem downstream. The drawdown schedule used is presented in Table 2. Flood control operation for this flood event was terminated on 16 November at 1400 hours when the pool returned to normal. Hydrographs of pertinent parameters relative to the operation of the W. Kerr Scott Project are presented in Figure 5.

TABLE 2

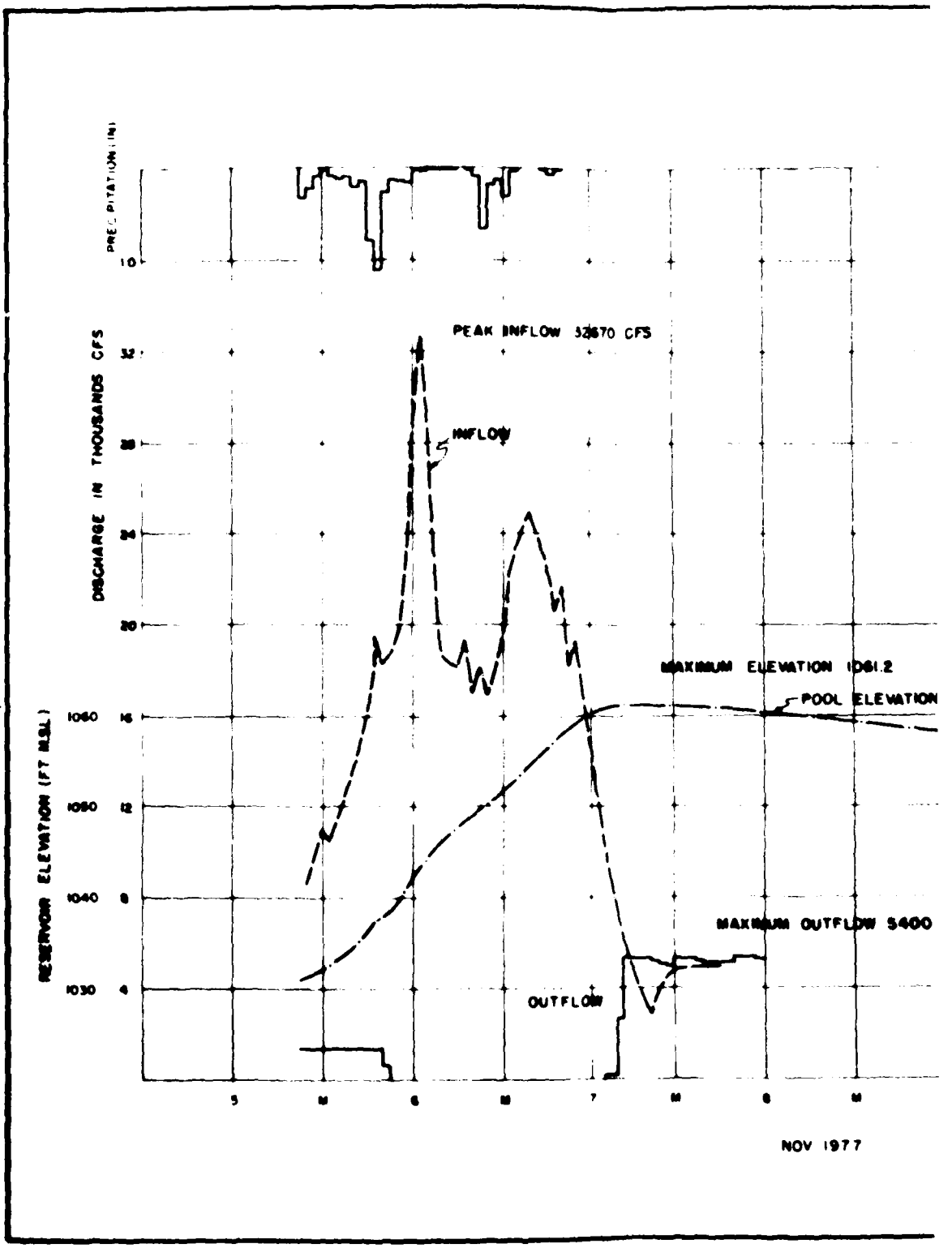
PROTRACTED RELEASE RATE REDUCTION

Pool Elevation	Release Rate (cfs)
Above 1033.0	5400
1033.0	4500
1032.5	4000
1032.0	3500
1031.5	3000
1031.0	2500
1030.6	2000
1030.4	1500
1030.2	1000
1030.0	Inflow

PROJECT EFFECTS

14. General. To ascertain the effects existing and potential Corps of Engineers projects had or would have had on this flood event, flood routings were performed and hydrographs derived for each considered condition at the Wilkesboro, Elkin, Enon and Yadkin College Index stations. The conditions considered and the methods and procedures used are discussed in the following paragraphs.

15. Flood Routings. All flood routings, whether to determine the natural unregulated condition or the regulated condition, had various potential reservoirs been in operation, utilized the coefficient method presented in Chapter 2 of EM-1110-2-1408. A variation of this


PRECIPITATION (IN)
1.0
DISCHARGE IN THOUSANDS CFS
32
28
24
20
16
12
8
4
PEAK INFLOW 32670 CFS
INFLOW
MAXIMUM ELEVATION 1061.2
POOL ELEVATION
MAXIMUM OUTFLOW 5400
OUTFLOW
RESERVOIR ELEVATION (FT M.S.L.)
1060
1050
1040
1030
5
M
6
M
7
M
8
M
NOV 1977

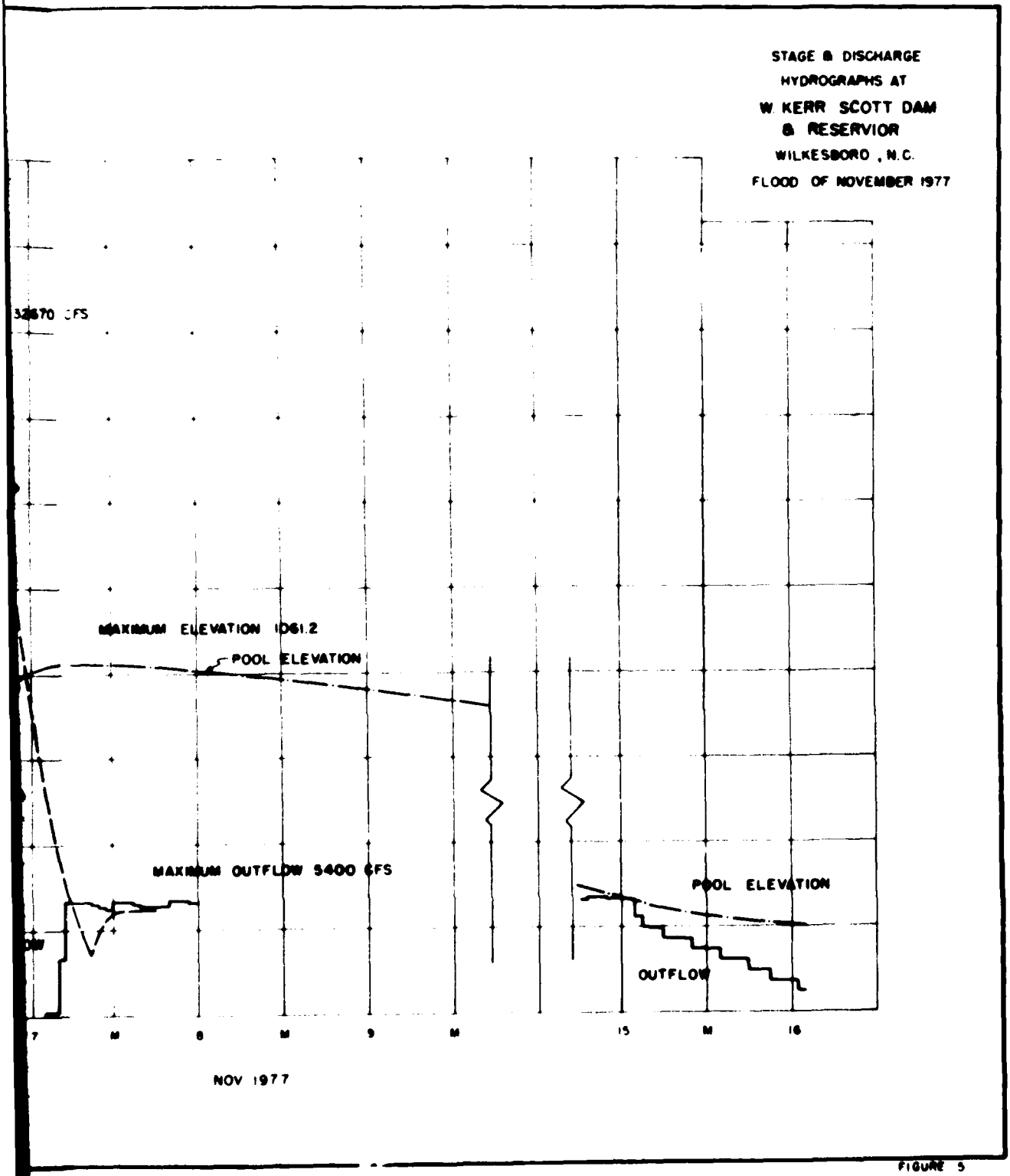

STAGE & DISCHARGE
HYDROGRAPHS AT
W. KERR SCOTT DAM
& RESERVIOR
WILKESBORO, N.C.
FLOOD OF NOVEMBER 1977
32670 CFS
MAXIMUM ELEVATION 1061.2
POOL ELEVATION
MAXIMUM OUTFLOW 9400 CFS
POOL ELEVATION
OUTFLOW
7
M
8
M
9
M
15
M
16
NOV 1977

FIGURE 5

procedure, popularly known as the Muskingum method, utilizes the concept of wedge storage which exists due to the inequality between inflow and outflow which occurs during the propagation of flood waves. This value, together with the steady-state or prism storage, constitutes the total amount of storage present in the reach, which is given by:

$$S = KO + KX\ (I-O)$$

This is the well-known Muskingum equation in which,

S = total storage present in the reach

K = coefficient related to the reach travel time

I = inflow

O = outflow

X = dimensionless relative weighting parameter for inflow and outflow

In the computational procedure, the reach is broken into a number of subreaches or routing steps and K is taken as the travel time through each individual subreach. Pertinent routing data as well as the values of K and X used in these routings, are given in Table 3.

TABLE 3

PERTINENT ROUTING DATA

Reach		Distance (miles)	Travel Time (hours)	Steps	Coefficients	
From	To				K	X
W. Kerr Scott Res.	Wilkesboro Gage	5.5	2	1	2.00	0.40
Wilkesboro Gage	Elkin Gage	26.0	7	6	1.52	0.20
Elkin Gage	Enon Gage	42.4	13	6	1.80	0.10
Enon Gage	Yadkin College Gage	34.6	11	6	4.53	0.05
Tributary Reservoirs						
Reddies R. Lake	Elkin Gage	28.2	8	6	1.52	0.20
Roaring R. Lake	Elkin Gage	18.6	5	6	1.23	0.20

16. Effects of Existing Corps of Engineers Projects. As stated previously, the only existing Corps of Engineers Project in the Upper Yadkin River Basin is the W. Kerr Scott Dam and Reservoir. To ascertain the effects the W. Kerr Scott Project had on this flood event, reservoir holdouts were routed, by the method previously described, to each of the index stations and added to the recorded hydrographs. This procedure produces the unregulated or natural hydrographs. The results of this analysis is presented in Table 4 where the peak stages and discharge rates that would have occurred had the W. Kerr Scott Project not been in operation are tabulated. The estimated unregulated hydrographs that would have occurred without the project are shown on Figure 6. As this analysis shows, peak stages would have been from 5 to 12 feet higher and peak discharge rates from 70 to 250 percent higher had W. Kerr Scott not been in operation.

17. Effects of Potential Corps of Engineers Projects. Although there are other potential reservoir flood control projects for the Upper Yadkin River Basin, the two most likely projects at this time are the Reddies River and the Roaring River Lake Projects. These two projects in combination with W. Kerr Scott, would have, for this flood event, controlled all flooding originating from the Yadkin River. Therefore, only these two projects were considered in assessing the effects of potential projects. The location of these projects are shown in Figure 7. Each are located on tributaries to the Yadkin River, one, Reddies, just above the Wilkesboro gage and the other, Roaring, between Wilkesboro and Elkin.

18. Both Reddies and Roaring River Lakes are authorized projects that are currently in the pre-construction planning phase. Revised Phase I GDM studies for Reddies River Lake are scheduled for FY 78 and 79. Phase I GDM studies for Roaring River Lake have currently been terminated and will be resumed when deemed appropriate. Had the Reddies River Lake Project been operational, it, in conjunction with the W. Kerr Scott Project, would have controlled completely flooding from the Yadkin River in the vicinity of Wilkesboro and reduced peak flood stages downstream of Wilkesboro from about 1.0 to 2.5 feet. Had the Roaring River Lake Project also been operational, the three reservoir system would have completely controlled Yadkin River flooding from this flood event. The recorded or peak stages as regulated by W. Kerr Scott and the estimated peak stages that would have occurred with the Reddies and Roaring Projects operational are given in Table 5. These peaks were estimated by routing probable reservoir holdouts for the Reddies and Roaring River Lake Projects to each index station and subtracting them from the appropriate discharge hydrographs. For Reddies, the appropriate hydrograph was the recorded one. This produces the regulated by Reddies and W. Kerr Scott condition. For Roaring, the appropriate hydrograph was the regulated by Scott and Reddies hydrograph. This produces a hydrograph regulated by Roaring, Reddies and Scott. In routing the reservoir holdouts, the same routing procedures as described in Paragraph 15 were used.

TABLE 4

Recorded Peak Flood Data and Effects of the W. Kerr Scott Reservoir Project
Flood of November 1977

Gaging Station	Recorded Data: Peak Discharge (cfs)	Recorded Data: Peak Stage (ft.)	Recorded Data: Day	Recorded Data: Hour	Predicted Without W. Kerr Scott Project: Peak Discharge (cfs)	Predicted Without W. Kerr Scott Project: Peak Stage (ft.)	Predicted Without W. Kerr Scott Project: Day	Predicted Without W. Kerr Scott Project: Hour	Reduction Attributable to Project (ft.)
		YADKIN RIVER							
Wilkesboro	11830	15.52	6	1500	41830	27.3	6	1400	11.78
Elkin	21940	21.09	7	0130	45270	31.2	6	2300	10.11
Enon	27050	19.83	7	1730	47650	24.94	7	2000	5.11
Yadkin College	23540	18.07	8	0900	40750	24.58	8	1200	6.51
		TRIBUTARIES AT GAGING STATIONS							
Reddies River	7250	12.70							
Roaring River	12640	16.53							
Mitchell River	1450	4.87	7	0700					
Fisher River	3930	8.30	7	1200					
Ararat River	3960	6.95	7	1545					
Elk Creek	11600	9.57							

TABLE 5

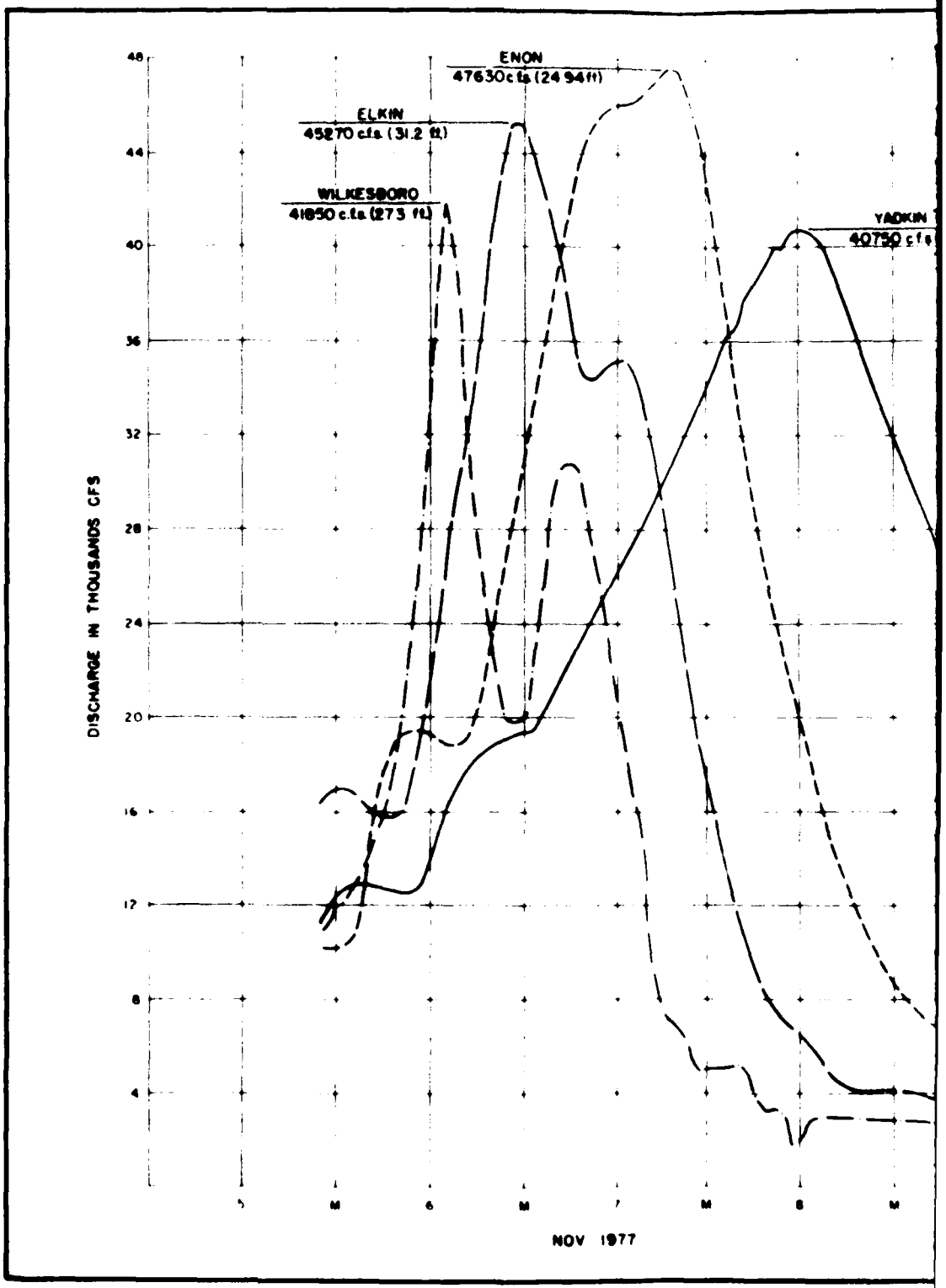
Effects of Potential Corps of Engineers Projects

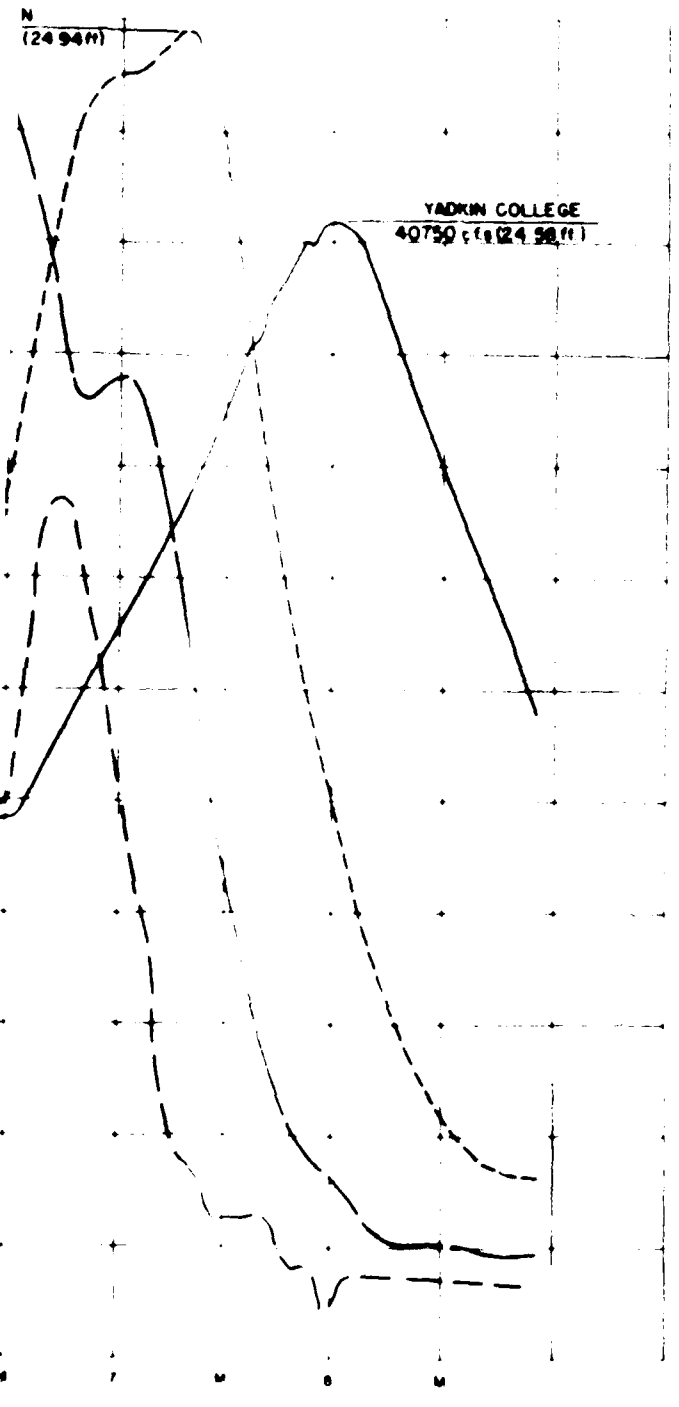
Index Station	Peak Stages in Feet Regulated by: W. Kerr Scott*	Reddies & Scott	Roaring, Reddies & Scott
Elkin	21.09	18.59	16.70
Enon	19.83	18.74	17.68
Yadkin College	19.07	16.58	---

* This is the existing or recorded condition

FLOOD DAMAGES

19. Flood damage survey. Representatives of the Charleston District were sent to Wilkesboro, North Carolina, on 7 November 1977, in order to survey flooding which was taking place preceding a declaration of a state of National Emergency in several counties of western North Carolina and in other states as well. This was primarily to pinpoint areas of heavy damage which would fall under Federal Disaster Assistance Administration jurisdiction and those areas which would not qualify, as well as doing a quick check of the conditions of dams in the area and the general conditions in the entire area due to flooding. Estimates of damages at that time were obtained from the appropriate local officials and combined with additional data available from previous studies in the area. Flood waters had already receded from the urban areas of Wilkesboro, North Wilkesboro and Elkin by the afternoon of 7 November. Urban and rural areas in those portions of North Carolina within the boundaries of the Charleston District were inspected both from the air and, where needed and possible, on the ground. Follow-up surveys were done in February, 1978, in order to obtain more detailed information on the effects of the flood in that area of the Yadkin River Basin below W. Kerr Scott Dam.


ENON
47630 c.f.s. (24.94 ft)
ELKIN
45270 c.f.s. (31.2 ft)
WILKESBORO
41850 c.f.s. (27.5 ft)
YADKIN
40750 c.f.s
DISCHARGE IN THOUSANDS CFS
48
44
40
36
32
28
24
20
16
12
8
4
5 M
6 M
7 M
8 M
NOV 1977



UPPER YADKIN RIVER

UNREGULATED
DISCHARGE HYDROGRAPHS

YADKIN RIVER, N.C.

BELOW W. KERR SCOTT RESERVOIR

FLOOD OF NOVEMBER 1977

FIGURE 6

20. Subdivisions of damage survey. To facilitate the collection and presentation of information relating to flood damages, the Upper Yadkin River was divided into five reaches as shown on Figure 7 and described below:

Reach	Description	Index Station
1	From W. Kerr Scott Dam to mouth of Roaring River	Wilkesboro Gage
2	Mouth of Roaring River to mouth of Mitchell River (includes Elkin-Jonesville)	Elkin Gage
3	Mouth of Mitchell River to mouth of Fisher River	Upper Donnaha Site
4	Mouth of Fisher River to potential Upper Donnaha Damsite	Upper Donnaha Site
5	Upper Donnaha Site to head of High Rock Lake	Yadkin College Gage

21. Assessment of Flood Damages.

a. General. The major damage resulting from this flood event was primarily concentrated in the upper portions of the watershed above W. Kerr Scott Dam and along tributaries of the Yadkin River with some flooding taking place as far downstream as High Rock Lake. A check of conditions as far downstream as the Forsyth County, North Carolina, border revealed scattered, minor damages, but not to the extent suffered elsewhere. Even though the majority of the flood damage that occurred was from flooding and erosion in tributary areas above the backwater effects of the Yadkin River, damages evaluated herein are limited to those caused by the Yadkin River and those that can be influenced by the operation of W. Kerr Scott Dam and Reservoir. In assessing the damages, four types of damages were considered. These were urban, rural non-agricultural, non-crop agricultural, and crops. Each of these types of damages are discussed in the following paragraphs. The damages derived for each type by reach is presented in Table 6. As shown there, the total damages derived for all reaches and all types of damages for this flood was $116,900.

b. Urban damage. Urban damage was concentrated at Wilkesboro and North Wilkesboro with some occurring in Elkin. Approximately seven businesses were directly effected by flood waters in Wilkesboro and North Wilkesboro. The commercial damages component included

moving merchandise and other contents out of and back into these businesses, earnings lost as a result of the flood, and damages to structures and contents from flood waters. Public properties and facilities sustaining damages in addition to roads and bridges, included sewage disposal facilities and water lines in Wilkesboro and recreational facilities in both Wilkesboro and North Wilkesboro. In Elkin, one business was flooded, with its merchandise having to be moved out. Jonesville, across the Yadkin from Elkin, had sustained substantial damages to a trailer park in the August 1970 flood, but these damages did not recur during the November 1977 flood. For reaches 1 and 2, the urban damage that occurred was estimated to be $57,900 and $10,200 respectively. This results in a total urban damage of $68,100.

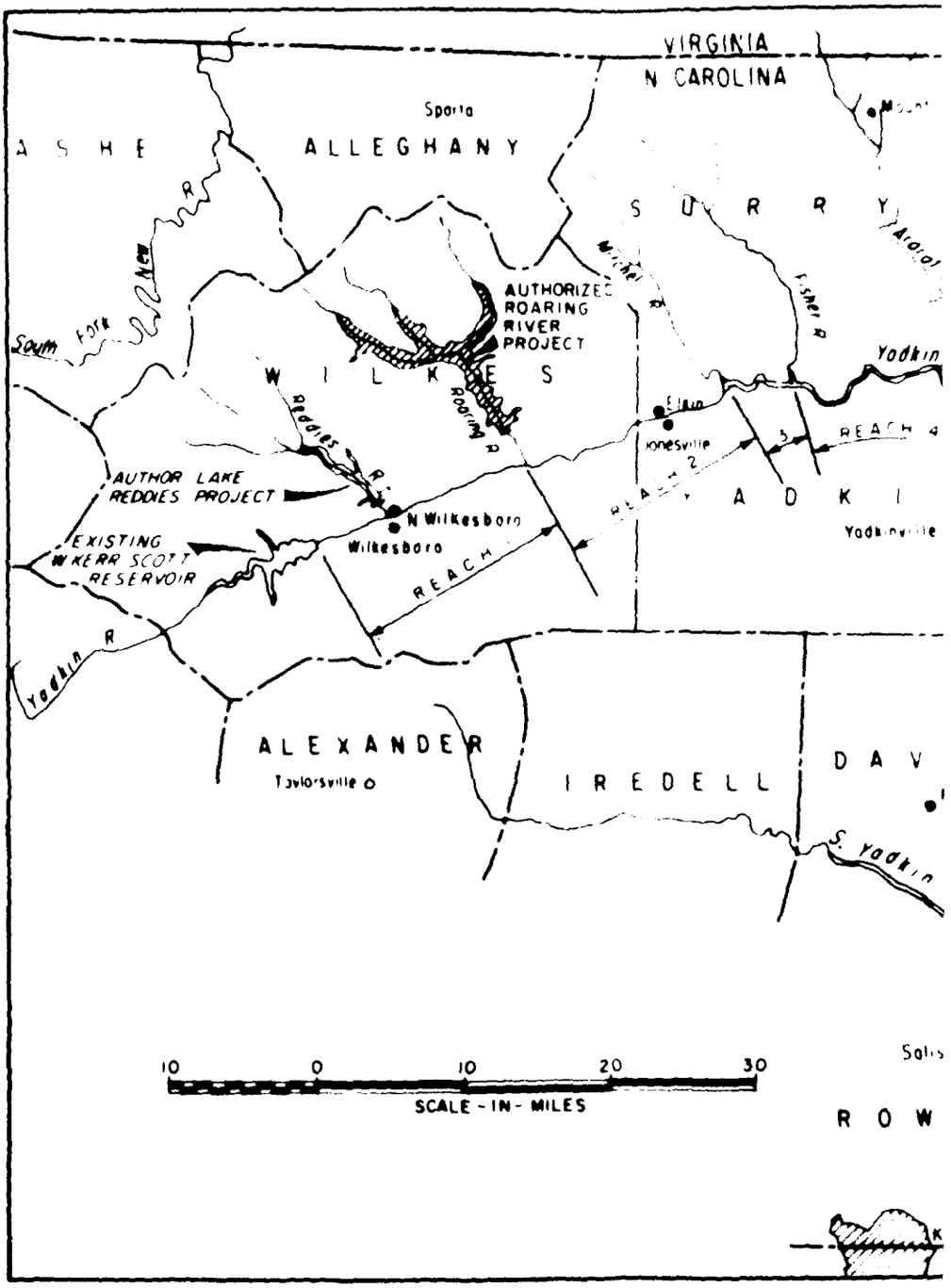
c. Rural non-agricultural. Included in this estimate are damages to industrial and commercial property as well as those to utilities and transportation facilities. Many roads above W. Kerr Scott Dam and Reservoir and along the tributaries below the dam were closed due to slides, bridge washouts and water over the roadways. Damages in this category caused by the Yadkin River were estimated at $18,000 - $6000 for reach 1 and $12,000 for reach 2.

d. Non-crop agricultural. Included in this estimate are damages to agricultural lands, livestock, equipment, ditches and structures used for farming operations. This damage was widespread throughout the mountainous part of western North Carolina. Damages totaling $30,800 were estimated to have occurred for this type of damage to the area under consideration in this report. Reach 1 had $12,800, while reach 2 had $18,000.

e. Crops. This agricultural damage category is listed separately because damages incurred will vary during the different seasons of the year. The main crops grown in this area are corn, soybeans, tobacco and truck crops. The November 1977 flood occurred after the end of the harvest season. Therefore, no crop losses are included in this report.

22. Lives Lost. A total of eleven flood-related deaths occurred in North Carolina during the period covered by this report. Although six of these fatalities were in areas within the Charleston District, none were reported in the Yadkin Basin itself. The majority of damages, both in monetary value and in loss of human life, occurred in the Broad and Catawba River Basins in the western mountains of the state.

23. Flood photographs. Selected photographs taken during the flood are shown on Figures 8 through 12. Several of these photographs were obtained through the courtesy of the Wilkesboro Journal and Patriot.


VIRGINIA
N CAROLINA
Sparta
ASHE
ALLEGHANY
SURRY
AUTHORIZED
ROARING
RIVER
PROJECT
South Fork New R.
WILKES
Reddies R.
Roaring R.
Elkin
Jonesville
REACH 4
AUTHOR LAKE
REDDIES PROJECT
N Wilkesboro
Wilkesboro
EXISTING
W KERR SCOTT
RESERVOIR
REACH
Yadkin R.
ALEXANDER
Taylorsville
IREDELL
DAV
S. Yadkin
10 0 10 20 30
SCALE - IN - MILES
R O W

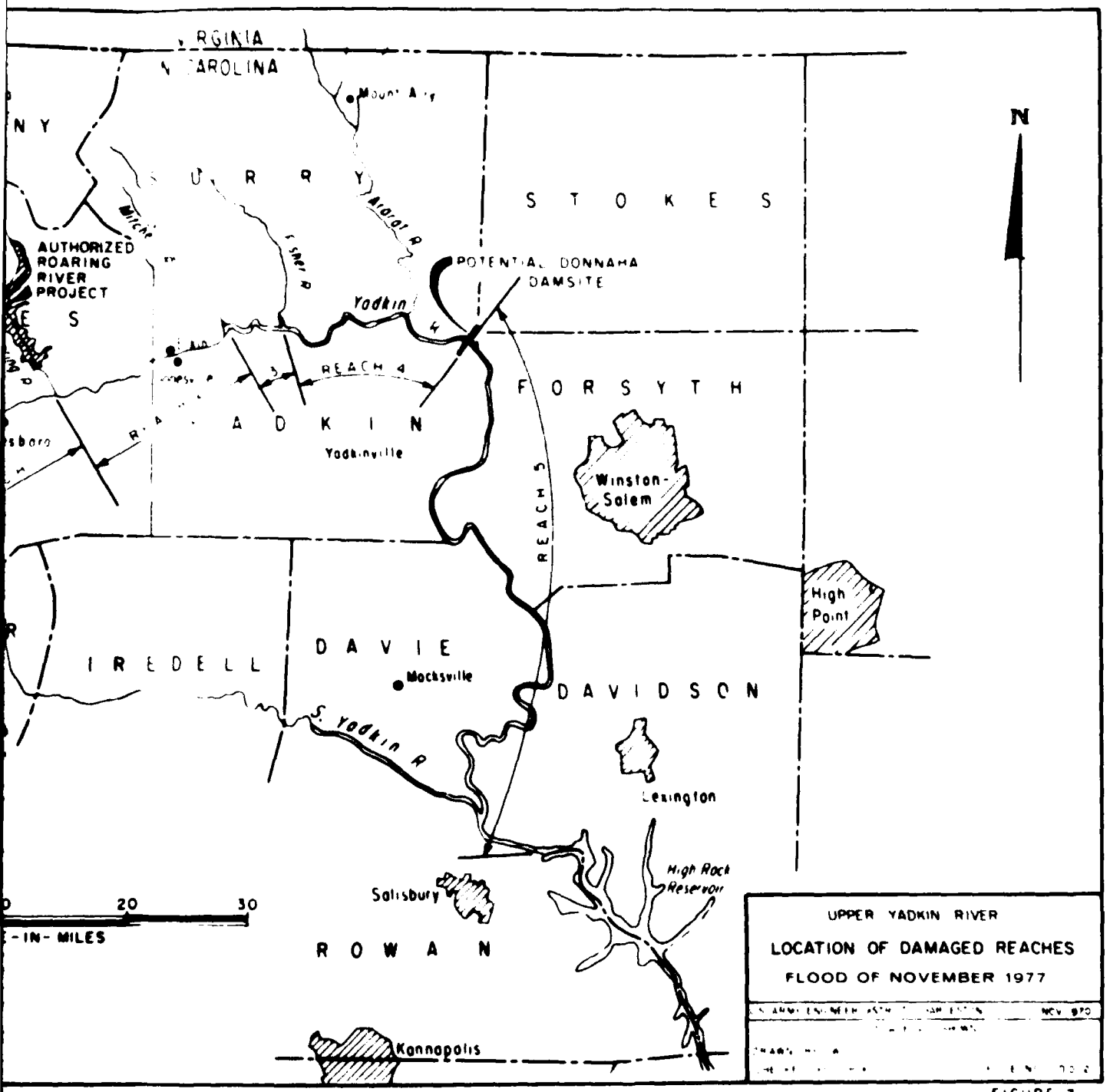

AUTHORIZED ROARING RIVER PROJECT
POTENTIAL DONNAHA DAMSITE
Yadkin R
REACH 4
REACH 5
Yadkinville
Winston-Salem
High Point
Mocksville
Yadkin R
Lexington
High Rock Reservoir
Salisbury
Kannapolis
SURRY
STOKES
FORSYTH
DAVIE
DAVIDSON
IREDELL
ROWAN
N
20
30
-IN- MILES
UPPER YADKIN RIVER
LOCATION OF DAMAGED REACHES
FLOOD OF NOVEMBER 1977

FIGURE 7

FIGURE 8 YADKIN RIVER FLOODING OF MIDTOWN PLAZA, TOWN OF NORTH WILKESBORO (REACH 1)

FIGURE 9 VIEW OF SCHOOL STREET, TOWN OF WILKESBORO (REACH 1) FLOODING BY MOROVIAN CREEK

FIGURE 10 VIEW OF WESTOVER DRIVE, TOWN OF WILKESBORO (REACH 1) RESIDENTIAL AREA FLOODED BY LITTLE CRIB CREEK

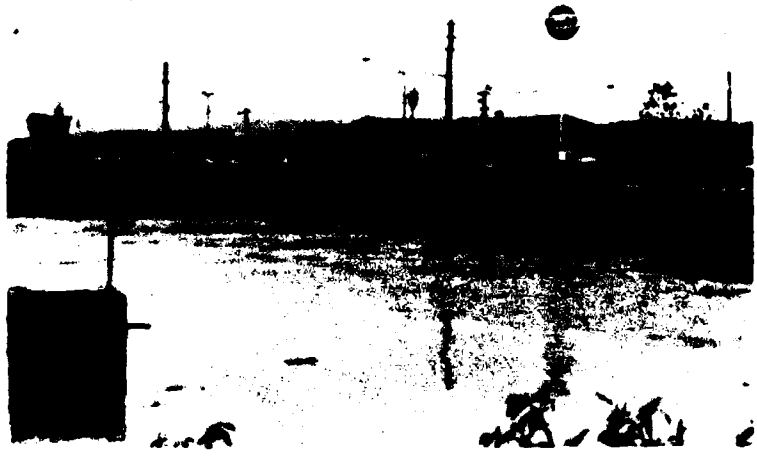


FIGURE 11 MOROVIAN CREEK AT STATE HIGHWAY 268 BRIDGE, TOWN OF WILKESBORO (REACH 1)

FIGURE 12 YADKIN RIVER AT COUNTY ROAD CROSSING BELOW CONFLUENCE WITH ROARING RIVER, WILKES COUNTY (REACH 2)

FLOOD DAMAGES PREVENTED

24. From Existing Corps of Engineers Projects. The W. Kerr Scott Dam and Reservoir is the only existing Corps of Engineers multiple-purpose project on the Upper Yadkin River. Damages prevented by this project are estimated to be $11,699,100. as shown in Table 6. The methods and procedures used in determining flood conditions without W. Kerr Scott are discussed in previous paragraphs of this report.

25. From Potential Corps of Engineers Projects. As stated previously, the two potential projects being considered in this report are the Reddies and Roaring River Lake Projects. The flood damages these projects would have prevented had they been in operation are shown in Table 7. As shown there, no damages from Yadkin River flooding would have occurred from this flood had these two potential projects along with the existing W. Kerr Scott project been in operation. The methods and procedures used in determining the effects both the Reddies and Roaring Projects would have had on existing flood conditions has been presented in earlier sections of this report.

HYDROLOGIC DATA NETWORK

26. River Stage and Rainfall reporting network. During this event, the W. Kerr Scott project office was able to monitor Yadkin River stages at Elkville, Wilkesboro, Elkin, and Enon. The reservoir stage and rainfall recorded at the damsite was periodically measured by project personnel. A telemetry system has been installed in the Upper Yadkin Basin which enables the project office to monitor hourly precipitation at Blowing Rock, Triplett, Wilbar, Patterson, Elkville and Laurel Springs, N. C. The system also monitors the hourly Yadkin River flows at Patterson, Elkville, Wilkesboro, Elkin, Enon and Yadkin College, N. C. For this flood, due to equipment malfunction, no reports were received from Yadkin College. The W. Kerr Scott Central Station is composed of a radio transceiver, a data processor, and a teletype machine. This system can be operated manually to interrogate any station at any particular time or, as presently programmed, all sites report automatically 45 minutes after every hour. Each of the 10 remote stations has a gage, an optical encoder, and a data system consisting of a logic package, radio transceiver and wet cell battery with charger. Additional parameters can be installed through the use of plug-in modules. Figure 13 shows the system as well as the individual station locations of the rainfall and river stage monitoring network.

TABLE 6

BENEFITS DUE TO W. KERR SCOTT DAM AND RESERVOIR
FLOOD OF NOVEMBER 1970

Reach No.	Type Damage	Estimated Damage W/O W. Kerr Scott	Damages With W. Kerr Scott	Benefits To W. Kerr Scott
1	Urban	8,534,000	57,900	8,476,100
	Rural Non-Agricultural	40,000	6,000	34,000
	Non-Crop Agricultural	33,000	12,800	20,200
	Crops			
	Sub-Total	8,607,000	76,700	8,530,300
2	Urban	2,723,800	10,200	2,713,600
	Rural Non-Agricultural	138,300	12,000	126,300
	Non-Crop Agricultural	46,200	18,000	28,200
	Crops			
	Sub-Total	2,908,300	40,200	2,868,100
3	Rural Non-Agricultural	3,000		3,000
	Non-Crop Agricultural	2,100		2,100
	Crops			
	Sub-Total	5,100	-0-	5,100
4	Rural Non-Agricultural	11,000		11,000
	Non-Crop Agricultural	1,500		1,500
	Crops			
	Sub-Total	12,500	-0-	12,500
5	Rural Non-Agricultural	170,800		170,800
	Non-Crop Agricultural	112,300		112,300
	Crops			
	Sub-Total	283,100	-0-	283,100
	Total	11,816,000	116,900	11,699,100

TABLE 7

Flood Damages Occurring and Benefits Creditable to Reddies and Roaring Lake Projects

Flood of 5-9 November 1977

Reach No.	Type Damage	Estimated Remaining Damage with W. Kerr Scott	Damages with Kerr Scott and Reddies	Damages with Kerr Scott, Reddies and Roaring	F.C. Benefits to Reddies	F.C. Benefits to Roaring
1	Urban	$57,900				
	Rural Non-Agricultural	6,000				
	Non-Crop Agricultural	12,800				
	Crops	-				
	Subtotal	$76,700	0	0	$76,700	0
2	Urban	$10,200	$ 2,000		$ 8,200	$ 2,000
	Rural Non-Agricultural	12,000	6,000		6,000	6,000
	Non-Crop Agricultural	18,000	9,000		9,000	9,000
	Crops	-	-		-	-
	Subtotal	$40,200	$17,000	0	$23,200	$17,000

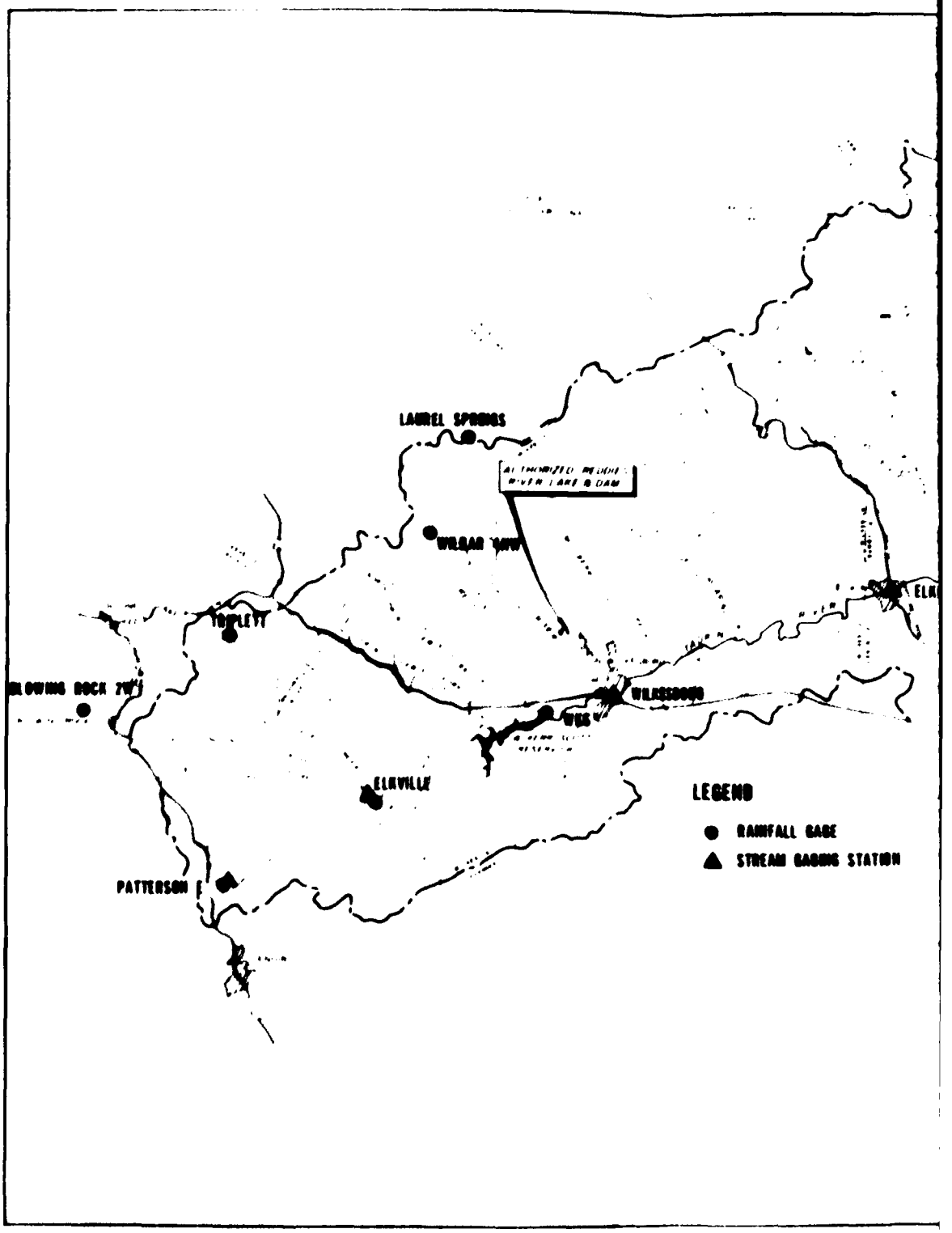
SACEN-PH 29 March 1978
SUBJECT: Final Report on the Flood of 5 Nov thru 9 Nov 1977, Yadkin-Pee Dee River, North and South Carolina

CONCLUSIONS AND RECOMMENDATIONS

27. Conclusions. It was concluded that the estimate of flood damages along the Yadkin River were for the most part accurately reported in the earlier reports prepared by this District. It is felt that this event, as well as other floods of recent years, offers strong support to the previously outlined need for other multiple-purpose projects on the Upper Yadkin River. It was also concluded that the operation of the W. Kerr Scott project during the flood emergency was executed in a responsible and professional manner. At this time no changes in the primary operating procedures are indicated.

28. Recommendations. None.

William W. Brown
WILLIAM W. BROWN
Colonel, Corps of Engineers
District Engineer


LAUREL SPRINGS
WILKESBORO
ELKVILLE
PATTERSON
LEGEND
RAINFALL GAGE
STREAM GAGING STATION

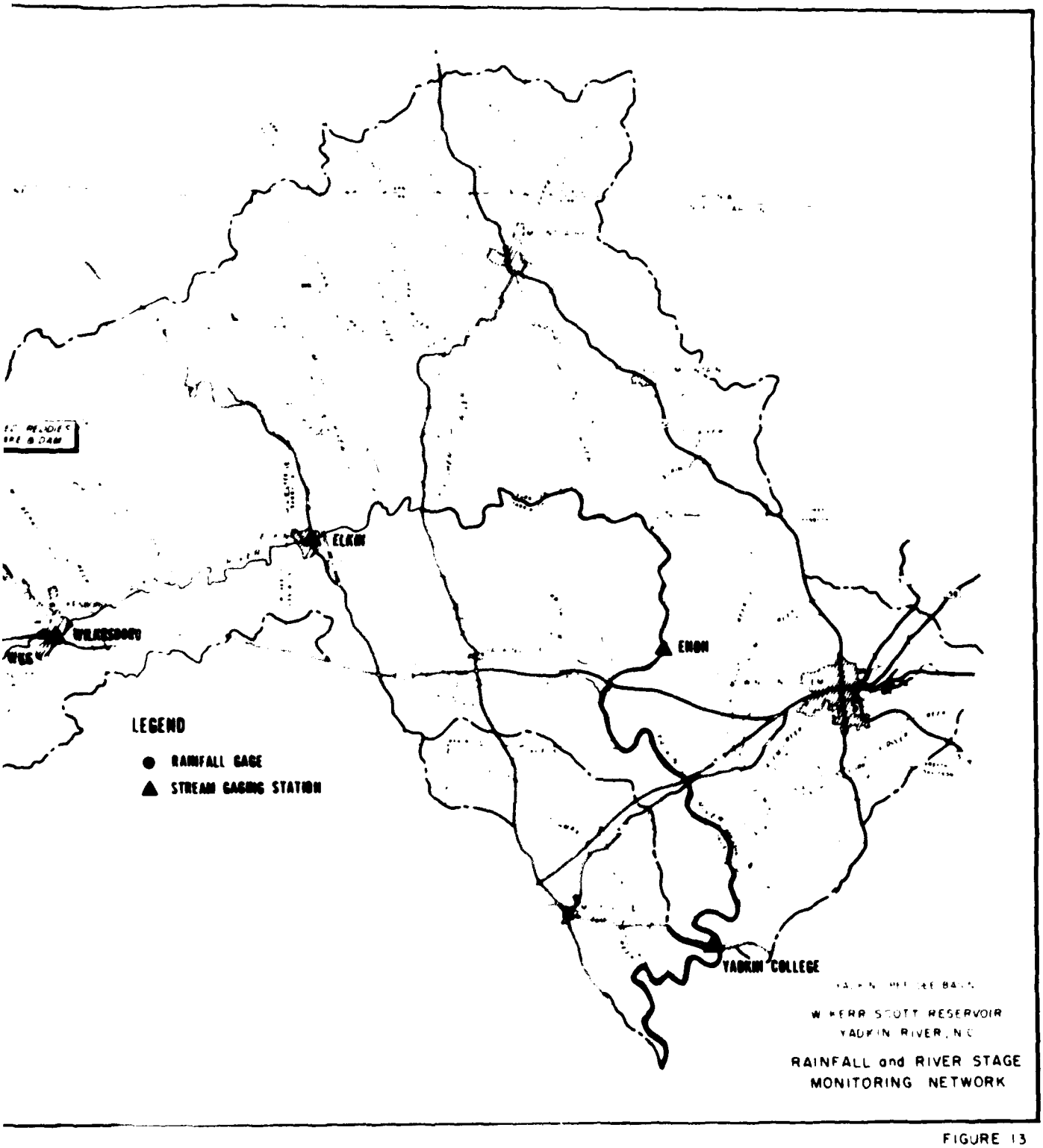

ELKIN
WILKESBORO
ENON
YADKIN COLLEGE
LEGEND
RAINFALL GAGE
STREAM GAGING STATION
W. KERR SCOTT RESERVOIR
YADKIN RIVER, N.C.
RAINFALL and RIVER STAGE
MONITORING NETWORK

FIGURE 13


DATE
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